Challenges to EHR Implementation in Electronic- Versus Paper-based Office Practices

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BACKGROUND: Challenges in implementing electronic health records (EHRs) have received some attention, but less is known about the process of transitioning from legacy EHRs to newer systems.

OBJECTIVE: To determine how ambulatory leaders differentiate implementation approaches between practices that are currently paper-based and those with a legacy EHR system (EHR-based).

DESIGN: Qualitative study.

PARTICIPANTS: Eleven practice managers and 12 medical directors all part of an academic ambulatory care network of a large teaching hospital in New York City in January to May of 2006.

APPROACH: Qualitative approach comparing and contrasting perceived benefits and challenges in implementing an ambulatory EHR between practice leaders from paper- and EHR-based practices. Content analysis was performed using grounded theory and ATLAS.ti 5.0.

RESULTS: We found that paper-based leaders prioritized the following: sufficient workstations and printers, a physician information technology (IT) champion at the practice, workflow education to ensure a successful transition to a paperless medical practice, and a high existing comfort level of practitioners and support staff with IT. In contrast, EHR-based leaders prioritized: improved technical training and ongoing technical support, sufficient protection of patient privacy, and open recognition of physician resistance, especially for those who were loyal to a legacy EHR. Unlike paper-based practices, EHR-based leadership believed that comfort level with IT and adjustments to workflow changes would not be difficult challenges to overcome.

CONCLUSIONS: Leadership at paper- and EHR-based practices in 1 academic network has different priorities for implementing a new EHR. Ambulatory practices upgrading their legacy EHR have unique challenges.

Abbreviations

EHR	electronic health records
IT	information technology
HIT	health information technology

BACKGROUND

Health information technology (HIT) is changing rapidly, affecting how clinicians in ambulatory care practice medicine. Electronic health records (EHRs) permit electronic documentation of current and historical health, tests, referrals, and medical treatments as well as enabling practitioners to order tests and medications electronically. EHR systems have the potential to improve communication between physicians and patients by making data more readily available. At the same time, the implementation of some new EHR systems has resulted in unexpected and deleterious consequences.[1,2] If health care organizations can successfully tailor the process of implementing new EHR systems to make the transition safer and more efficient, then the enhancements they offer to health care practitioners will likely be realized more rapidly.

Because of consumer demand, commercially available EHR systems are maturing with increasing customization features for unique needs (e.g., growth curves for pediatricians) and with increasing use of standards, thereby encouraging interoperability. Although many small ambulatory care practices have yet to adopt their first EHR, many academic institutions are already upgrading to newer generations of software.

For all ambulatory care practices in the United States, there is a national goal to have universal adoption of EHR systems by 2014.[3] Currently, only 17–25% of office-based physicians use EHR systems.[4] At this rate, it is predicted that EHRs will reach maximum penetration by the year 2024, 10 years

beyond this goal.[5] Reasons for the lack of adoption are not fully understood but include physician resistance, financial costs, concerns about privacy, lack of uniform standards, and little information about best practices for implementation.[6,7]

Current literature has focused primarily on implementing EHR systems in paper-based practices.[8–12] Practices replacing their EHR legacy system may face unique challenges such as data migration between different vendor products and practitioner's brand loyalty to older EHRs. Before implementation of a new EHR system in the ambulatory setting at 1 academic medical institution, we compared and contrasted perceived benefits and challenges to implementation between paper- and electronic-based practice leaders.

METHODS

Background and Setting

We interviewed managers and medical directors at 12 ambulatory care practices before the implementation of the new EHR system. Services provided at these practices included Internal Medicine, Obstetrics and Gynecology, Pediatrics, Geriatrics, and Family Medicine. The practices are part of the Ambulatory Care Network (ACN) of a large teaching hospital in New York City and serve as training sites for medical students, residents, fellows, and other health-related trainees.

In 2005, the ACN began planning for the implementation of an EHR system to launch in 2006. Senior leadership sought to provide the ACN office practices comprehensive EHR systems that would allow sharing of medical information between practitioners and in turn improve access to that information across multiple practices, ideally improving the quality and safety of care for all patients. Two commercial EHR products were chosen, both designed to collect health information and data, review results, order tests and laboratory analyses, provide decision support, facilitate electronic communication and connectivity through remote access, and create registries.

The ACN practices were quite heterogeneous in terms of the clinical functions their HIT systems could support. Some practices had electronic systems that included virtually all patient data (e.g., those with legacy EHR systems), whereas others were limited to certain types of electronic data, such as ordering or reviewing medications and laboratory tests. We defined EHR-based ambulatory practices as those with legacy EHR systems that had at least 4 key capabilities as defined by the IOM report "Key Capabilities of an Electronic Health Record System" (i.e., health information and data, order entry/management, electronic communication and connectivity, and reporting and population health management).[13] Paper-based practices were defined as those with limited electronic data and had little to no ability to electronically document patient encounters or keep track of health maintenance information, relying on paper to record such data.

DESIGN AND SUBJECTS

We conducted a preimplementation, qualitative study of 12 academic ambulatory practices in which we interviewed 11 practice managers (one practice manager works in 2 office practices) and 12 medical directors. All but 2 interviews included the medical director and practice manager who were present simultaneously. Interview subjects were chosen because of their influence and oversight responsibilities during the EHR implementation process.

DATA COLLECTION

Interviews were conducted by 3 investigators (Langsam, Yoon-Flannery, and Zandieh) from January to May 2006. We used a semistructured interview instrument that ensured consistent coverage of key topics and allowed us to capture unanticipated issues and experiences in respondents' own words. Each interview consisted of briefing the subject(s) of the purpose of the interview (to ascertain their perceptions), followed by asking interviewees open-ended questions about their: current satisfaction with quality of care and access to patient medical information, past experiences with health information technologies, and expectations regarding the implementation of a new EHR system. During the interviews, verbatim notes were taken and later transcribed. This study received human subjects' approval by the institutional review board of 2 participating academic institutions.

DATA ANALYSIS

Two reviewers (Yoon-Flannery, Zandieh) independently analyzed the transcripts. A sentence or phrase in the transcripts served as the unit of analysis for coding purposes. Content analysis was performed using a grounded theory approach to identify emergent themes.[14] ATLAS.ti 5.0 software package was used to extract, compare, explore, and reassemble the data to further delineate the relationships among emerging themes.

In accordance with the grounded theory, after independent analyses, the reviewers engaged in an iterative process, which began with a description of the data and code assignments and ended with identification of benefits and challenges. Differences were reconciled by consensus through discussion with senior investigators. First, we examined 358 quotes and phrases (162 quotations were from paper-based leaders and 196 from EHR-based leaders). Second, we assigned each quotation 1 or more codes using the respondent's own words to guide the development of codes. For example, the quote "A slow learning curve is expected…" was given 3 codes, "paper-based respondent," "learning curve," and "challenge." In total, we assigned 45 codes to characterize the benefits and challenges to implementing an EHR. Third, we determined that these 45 codes represented 4 major concerns that practice leaders believed needed to be addressed to successfully implement an EHR. Last, we examined the similarities and differences between EHR- and paper-based leaders' perceptions.

RESULTS

Practice Characteristics and HIT Functionalities

We interviewed 9 practice leaders from 5 EHR-based practices and 14 practice leaders from 7 paper-based practices. Paper- and EHR-based practices were comparable in terms of specialty and patient visits (Table 1). Practices significantly

Table 1. Characteristics of Practice Sites and Level of Adoption of Clinical HIT Applications

Practice type*	Number of patient visits per year	Percent Medicaid	Electronic ordering	Electronic medical prescriptions	Medical documentation
Internal Medicine	76,000	70	No	No	Paper-based
Multispecialty†	37,000	88	No	No	Paper-based
Multispecialty	34,000	80	No	No	Paper-based
Multispecialty	16,500	75	No	Yes	Paper-based
Geriatrics	9,000	15	No	Yes	Paper-based
Multispecialty	44,498	85	No	Yes	Paper-based
Multispecialty	29,102	20	Yes	Yes	Paper-based
Family medicine	25,000	74	No	Yes	EHR-based
Pediatrics	14,949	94	No	Yes	EHR-based
Internal Medicine	60,931	28	Yes	Yes	EHR-based
Obstetrics–Gynecology	14,454	87	Yes	Yes	EHR-based
Geriatrics	6,900	2	Yes	Yes	EHR-based

All practices currently use electronic systems for billing, patient scheduling and reviewing laboratory results.
†*Multispecialty practices include Internal Medicine, Pediatrics, Obstetrics/Gynecology, and Geriatrics.*

differed in their electronic capabilities; 5 out of 12 practices had EHR systems that allowed for electronic documentation of patients' current and past health as well as electronic ordering and reviewing of laboratory and radiological tests. The other 7 practices used paper systems to record clinical data but used electronic systems to schedule and bill patients. Many of the practices had the capability of generating prescriptions electronically, but practitioners continued to handwrite the majority of them.

Perceived Advantages of EHRs

Advantages cited by leaders of paper-based systems included: improved communication, ability to have remote access of patient information, and improved revenues (Table 2). All 14 perceived that EHRs would provide improved communication between practitioners and patients as well as among practitioners. For example 1 paper-based system leader stated: "[we expect] improved communication between inpatient and ambulatory practices; information retrieval between these two [sites] is currently difficult and time-consuming." Another believed that "improved ability to read other people's notes is a definite plus... legibility is crucial in coordinated patient care." Still another stated, "sometimes it takes great imagination to figure out someone else's handwriting." Half the paper-based system leaders (7 of 14) were especially interested in having remote access to patient information. One stated an EHR would "enable physicians to provide more knowledgeable advice during off-site/off-regular hours." Lastly, a few paper-based system leaders mentioned that they expected the EHR to improve overall practice efficiency and revenue. Two perceived enhanced efficiency would be created through decreasing time-consuming activities such as chart retrieval. Another believed the EHR would boost revenues by "improving billing and collection by [capturing] the true work load."

Advantages perceived by EHR-based system leaders included: an improved new EHR product, enhanced streamlining of workflow processes, better information technology (IT) resources, and remote access to patient information (Table 3). Seven were hopeful that the new EHR would improve electronic functionalities by "filling in the gaps" that they perceived as missing from their current systems. Four perceived that the new EHR would have improved functionality: "creating notes that are coherent,

substantive and billing-compliant is difficult and the biggest problem [for our legacy system]." Three believed the staff would have more free time because of increased automation of workflow processes: "having automated encounter forms with the ICD-9 codes linked will be very helpful and result in more effective use of

Table 2. Paper-based Respondents' Perceived Benefits and Challenges in Implementing an EHR

Perceptions	Quotes
Benefits	
Improve communication	"Sometimes it takes great imagination to figure out someone else's handwriting."
Allow remote access	"Improving billing and collection by [capturing] the true work load."
Boost revenues	
Decrease time spent retrieving patient charts	"[We expect] improved communication between inpatient and ambulatory practices; information retrieval between these two [sites] is currently difficult and time-consuming."
Challenges	
IT issues	
Acquire sufficient workstations and printers	"We [medical director and practice manager] cannot assess the exact level of technological need until the [staff physicians] are trained with the program and can see how many workstations will be necessary for smooth transition."
Designate a physician champion at the practice	
Enhance comfort level of practitioners and support staff with IT	"Comfort level with the program and allocating an appropriate amount of time for training will have an impact on the patient volume and overall budget."
Improve typing skills of staff	
Workflow and efficiency	
Decrease productivity	"[We expect] 2–3 weeks of disastrous inefficiency followed by 4–6 months of relative inefficiency."
Safety and quality	
Increase access to patient information	"Enable physicians to provide more knowledgeable advice during off-site/off-regular hours."
Improve patient privacy	"This new EHR system will provide more security than the current paper-based system... every decision and step can be tracked by the sign-in process."

Table 3. EHR-based Respondents' Perceived Benefits and Challenges in Implementing an EHR

Perceptions	Quotes
Benefits	
Enhance electronic functionalities	"Having automated encounter forms with the ICD-9 codes linked will be very helpful and result in more effective use of the front staff time."
Improve use of staff time as a result of automation of work-flow processes	
Increase IT resources	"Creating notes that are coherent, substantive and billing-compliant is difficult and the biggest problem [for our legacy system]."
Allow remote access	"[Our legacy system] is a proprietary system; there will be less risk involved with [the new EHR] in comparison."
Challenges	
IT issues	
Increase technical training and ongoing technical support	"Training will also be an issue; currently with [our legacy EHR], only about 50% of what it can offer is utilized."
High practitioner resistance	"Change in itself will be a barrier for this implementation since practitioners are already set in their ways to do certain things."
	"There will be great resistance by practitioners against the new EHR implementation, particularly since this decision really had nothing to do with [their legacy system] in mind ... our practitioners are very happy with [our legacy system] currently."
Workflow and efficiency	
Decrease productivity	"Since the practice has already gone through an EHR implementation process... staff productivity will not go down drastically with the [new EHR system]."
	"Disruption is expected; however, all our [staff] are already used to working with computers."
Safety and quality	
Decrease patient privacy	"I don't have faith about who is reading this intimate information."

the front staff time." Additionally, all 9 EHR-based system leaders perceived a unique advantage that was not mentioned by leaders of paper-based systems: switching to a new EHR created by reputable and financially secure companies would provide a more stable EHR product with greater IT support. One respondent stated, "[our legacy system] is a proprietary system; there will be less risk involved with [the new EHR] in comparison." Another stated, "having improved technical support staff [with the new EHR] is another advantage." Similar to leaders of paper-based systems, 4 EHR-based leaders were eager to have remote access to patient information. Although some EHR-based practices could view patient data from a distant location, few could enter or change data. These leaders of EHR-based systems

agreed that "remote access allows practitioners to work more efficiently from home [especially] when taking night calls."

Identified Concerns Regarding Implementation

IT Issues at the Office Practice. One perceived challenge of introducing a new EHR system was determining the type and extent of IT support necessary for successful implementation. All our respondents stated that essential IT resources included: sufficient workstations, printers, and internet connections; an EHR product appropriately tailored to meet each practice's unique needs; an adequate amount of training and technical support; and the creation of high personnel comfort levels with IT.

Leadership from paper-based practices focused on the following: obtaining hardware (all 14 respondents), having a physician champion at their practice site (5 out of 14 respondents), and improving comfort level of practitioners and support staff with IT (14 respondents). An often cited concern was obtaining sufficient hardware. For example, at 1 paper-based practice site, the medical director stated, "we [medical director and practice manager] cannot assess the exact level of technological need until the [staff physicians] are trained with the program and can see how many workstations will be necessary for smooth transition." At another practice, a respondent felt that resources were not efficiently allocated: "Physicians were told to all go across the hall to the networked, shared printer to pick up printed prescriptions during each visit... [so] we requested additional printers be stationed in exam rooms."

In contrast, leaders of EHR-based systems were less concerned about hardware (1 respondent discussed this issue) or an IT champion (no EHR-based system leader mentioned this topic); instead, their concerns concentrated on adding technical support and improving training. Four practice managers indicated that the current level of IT support was adequate but could be more responsive. As 1 practice manager stated, "currently [IT support] do not see the urgency of some of the problems that have been brought up." In regard to training, 1 respondent said, "training will also be an issue; currently with [our legacy EHR], only about 50% of what it can offer is utilized." Another respondent went a step further, saying "[finding time for] adequate training when the practice is already quite busy will be another challenge."

IT Issues at the Individual Level. For leaders of both paper- and EHR-based systems, further perceived challenges at the individual level were: developing typing skills, improving comfort level with IT, and decreasing resistance to changing workflow patterns.

All 14 leaders of paper-based systems perceived skills of staff and comfort level with IT as their biggest challenges. Some believed these challenges could be addressed with proper training. One respondent stated, "...comfort level with the program and allocating an appropriate amount of time for training will have an impact on the patient volume and overall budget." Similarly, another respondent stated, "medical assistants and nurses will be expected to use the new EHR; there may be lots of variation in technology comfort level among support staff. Training these folks adequately and making sure they are comfortable with the EHR are important."

Leaders of EHR-based systems had different concerns; resistance to change was perceived as their biggest challenge (all 9 respondents). For example, when asked about IT comfort level, 1 respondent stated, "I do not consider this to be a big factor since staff are comfortable with using computers in general." However, 6 respondents agreed that "change in itself will be a barrier for this implementation since practitioners are already set in their ways to do certain things." As well, EHR-based practices had legacy systems that were already well liked, with loyal users. Another respondent stated, "there will be great resistance by practitioners against the new EHR implementation, particularly since this decision really had nothing to do with [their legacy system] in mind ... our practitioners are very happy with [our legacy system] currently." How these practices might be overcome was unclear. One respondent stated from past experience, "Our past implementation [of the legacy system] was a painful transition. [We] had to force some people to fully use the electronic system."

Workflow and Efficiency. A second essential concern related to process modifications (such as patient flow patterns) needed to improve workflow and efficiency. Leaders from both types of practices were worried about decreased practitioner productivity during the implementation and its impact on day-to-day operations. Yet, leaders of paper-based systems were more apprehensive. For example, a respondent at a paper-based practice said he expected "2–3 weeks of disastrous inefficiency followed by 4–6 months of relative inefficiency." However, a leader from an EHR-based system reported "since the practice has already gone through an EHR implementation process...staff productivity will not go down drastically with the [new EHR system]."

Regarding workflow, respondents' concerns followed a similar trend. EHR-based leaders had already made adjustments to accommodate a paperless system as opposed to leaders of paper-based systems, which had not and were uncertain how to proceed. A respondent at a paper-based practice was unable to respond to our question about the impact an EHR would have on workflow. Instead, the respondent began answering our questions with further questions: "What will happen when the system is down during office hours? How will the visit details be recorded? Will the physicians have to convert back to note-taking, instead of entering information directly into the EHR?" This uncertainty was echoed several times by other leaders of paper-based systems. In contrast, a respondent from an EHR-based practice calmly stated, "Disruption is expected; however, all our [staff] are already used to working with computers."

Patient Outcomes and Security. The last essential challenge related to the expected impact of the EHR upon patient health outcomes, including benefits derived from improved coordination as well as challenges such as potentially decreased privacy and security. Leaders of both practice types thought that in the long term, the new EHR would improve patient care by improving communication among practitioners. Four paper-based system leaders thought the new EHR would improve patient privacy: "This new EHR system will provide more security than the current paper-based system... every decision and step can be tracked by the sign-in process." Unlike respondents in paper-based systems, 7 EHR-based leaders perceived that the new improvements in communication and access might result in infringements of patient privacy and confidentiality. Despite the fact that at all the EHR-based practices, patient data are secured with several layers of protection, all leaders of EHR-based systems had concerns. For example, 1 respondent stated, "currently the patient data in the practice are not particularly protected. I am unsure how to secure information [for] limited people, whereas offering accessibility to people who need the data." Another respondent said, "I don't have faith about who is reading this intimate information." Particularly, EHR-based respondents felt that patient confidentiality could be compromised because of the increased availability of the data.

DISCUSSION

Implementing a new EHR system is complex especially at academic institutions that have many diverse ambulatory care practices each with varying electronic capabilities. At 1 institution, we found that ambulatory leaders had a wide range of priorities ranging from concerns about adequate workstations and technical support to insuring confidentiality and privacy for patients. Using qualitative analysis of interviews with leaders in paper- and EHR-based practices, we found that both had similar concerns regarding practitioner productivity and training. We also found differences. Leaders of paper-based systems prioritized the following: sufficient workstations and printers, a physician IT champion at the practice, workflow education to ensure a successful transition to a paperless medical practice, and a high existing comfort level of practitioners and IT support staff. In contrast, leaders of EHR-based systems prioritized: open recognition of physician resistance especially for those who were loyal to the legacy EHR, improved technical training, ongoing technical support, and sufficient protection of patient privacy.

Resistance to change is always a crucial challenge for the success of any innovation. Research has found that physician resistance is a challenge in the implementation of a new EHR system when switching from a paper-based practice.[7,8,11,15] One might expect that resistance would decrease after a practitioner began using an EHR thereby facilitating the transition to a new system. However, our study findings indicate otherwise. An important finding of this research is that leaders of EHR-based systems believed that resistance toward implementation of a different EHR system was a formidable challenge to overcome. Practitioners may be reluctant to adopt new ways of doing things that interfere with their workflow, taking time away from patient care.[16] One previous case study in the inpatient setting explored the transition from 1 EHR system to another. Medical directors unexpectedly encountered high levels of practitioner resistance that ultimately led to its failure.[17] An important lesson learned from this experience was that during the early stages of the transition, a cooperative environment, which was conducive to minimizing initial resistance later, became an impediment: "At times [it] exacerbated implementation challenges or encouraged passive resistance." Building a cooperative culture is important, especially when selecting an EHR product; however, during the implementation process, a directive leadership style may be necessary for success.

Another important finding of our study is that although both paper- and EHR-based system leaders had important concerns about decreased productivity, it appeared that paper-based leaders were more apprehensive. This is understandable, as implementation of an EHR system causes disruption to the office practice, requiring changes at all levels (e.g., acquiring new and expensive equipment, redesigning workflow patterns, and re-educating practitioners). Although this apprehension may be reasonable, it is important for senior leadership to address to optimize for success. We suggest that senior management provides practice leaders with IT training and also have them visit EHR-based practices. In this way, leaders can observe a paperless practice in operation, gain deeper understanding about adaptations that will have to be made and alleviate undue concerns.

Information sharing can be a great incentive for adoption of an EHR system, but it also creates challenges for maintaining patient privacy and confidentiality.[18,19] We found that leaders of paper- and EHR-based practices had different perceptions about the effects an EHR system has on patient privacy. Leaders of paper-based systems expected that the EHR would increase patient privacy, whereas leaders of EHR-based systems were concerned that the EHR may be less secure, a view supported by at least 1 published report.[20] Privacy is of concern to patients and practitioners and is a known barrier to adoption.[21,22] The Department of Health and Human Services has invested significant resources to develop a comprehensive strategy for protecting health information, including the creation of an American Health Information Community's Confidentiality, Privacy, and Security workgroup comprised of privacy, security, clinical, and technology experts.[23]

Unlike ours, many studies have found that costs are an important challenge to overcome.[7,8,15] The high costs of implementing an EHR system are often prohibitive. Costs are often an adoption challenge to office practices and an implementation challenge to individual practitioners whose salaries are dependent on productivity. This was not true for the participants in our study because the larger hospital network had made the financial investments necessary to purchase and implement the new EHR system and the vast majority of staff practitioners were salaried, buffering their personal income against an expected decrease in patient volume.

Our study has several limitations. First, this is a qualitative study, generating hypotheses that need further investigation. Second, although we conducted interviews at 12 diverse ambulatory practices located in Manhattan, all respondents were faculty associated with 2 academic-based institutions affiliated with 1 hospital, thereby limiting our ability to generalize. Third, although we interviewed important leaders at each practice site, we did not obtain the perspectives of staff practitioners, support staff, or patients potentially limiting our view of the barriers and facilitators of implementation. Lastly, implementing an EHR is a dynamic process; this was a preimplementation study assessing anticipated challenges at only 1 point in time.

Implementation of a new EHR requires consideration of an ambulatory practice's baseline system, paper or EHR based, because each has its own unique advantages and challenges. Previous studies have shown that the implementation of an EHR system if done prudently can improve quality of care[24] but if done ineffectively can increase risks to patients.[2] Because adoption of EHRs has been slow, with notable failures, efforts to understand and overcome the challenges to implementation are vitally important not only for paper-based practices but also for those changing from a legacy system to a new EHR.

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